How does Nature change lifespan?

Awardee: Vadim N. Gladyshev
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Awardee Institution: Brigham and Women's Hospital

Understanding the mechanisms that control lifespan is among the most challenging biological problems. Many complex human diseases are associated with aging, which is both the most significant risk factor and the process that drives the development of these diseases. It is clear that the aging process and the maximum lifespan of species can be regulated and adjusted. For instance, mammals are characterized by >100-fold difference in lifespan, which can both increase and decrease during evolution. We employ this diversity in mammalian lifespan and the associated life-history traits to shed light on the mechanisms that regulate species lifespan. For this, we utilize methods of comparative genomics to sequence and examine the genomes of exceptionally long-lived species and carry out analysis of lifespan across a panel of mammals. We sequenced the genomes of several mammals with exceptional lifespan, including the naked mole rat, the Damaraland mole rat, and the Brandt's bat, and identified genes that contribute to their longevity. We also work with the longest lived mammal, the bowhead whale. In addition, we apply RNAseq and metabolite profiling approaches to characterize the molecular basis for adaptations associated longevity across mammals. These studies point to both lineage-specific and common processes involving various pathways and provide the first insights into how Nature changes species lifespan. It is our hope that a better understanding of molecular mechanisms of mammalian lifespan control will lead to a better understanding of human diseases of aging.